AUSTRALIAN INTERNATIONAL TRADE

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Dataset Characteristic

This report will utilise the Australian International Trade dataset extracted from ABS Statistics data contains over 30 years of data between 1988 and 2022. The dataset has import and export information, including 10 main categories and 67 sub-categories. Each sub-category involves multiple industries' performances on productivities and resources.

Main category involves:

Category 0	Food and live animals
Category 1	Beverages and tobacco
Category 2	Crude materials, inedible, except fuels
Category 3	Mineral fuels, lubricants and related materials
Category 4	Animal and vegetable oils, fats and waxes
Category 5	Chemicals and related products
Category 6	Manufactured goods classified chiefly by materials
Category 7	Machinery and transport equipment
Category 8	Miscellaneous manufactured articles
Category 9	Commodities and transactions not classified elsewhere in SITC

Category 0 will be chosen as the main category for this study and its sub-categories involves:

Sub-category 0	Live animals (excl. fish (not marine mammals) crustaceans, molluscs and aquatic invertebrates of SITC Division 03)
Sub-category 1	Meat and meat preparations
Sub-category 2	Dairy products and birds' eggs
Sub-category 3	Fish (excl. marine mammals) crustaceans, molluscs and aquatic invertebrates, and preparations thereof
Sub-category 4	Cereals and cereal preparations
Sub-category 5	Vegetables and fruit
Sub-category 6	Sugars, sugar preparations and honey
Sub-category 7	Coffee, tea, cocoa, spices, and manufactures thereof
Sub-category 8	Feeding stuff for animals (excl. unmilled cereals)
Sub-category 9	Miscellaneous edible products and preparations

Raw Dollar Value Trends

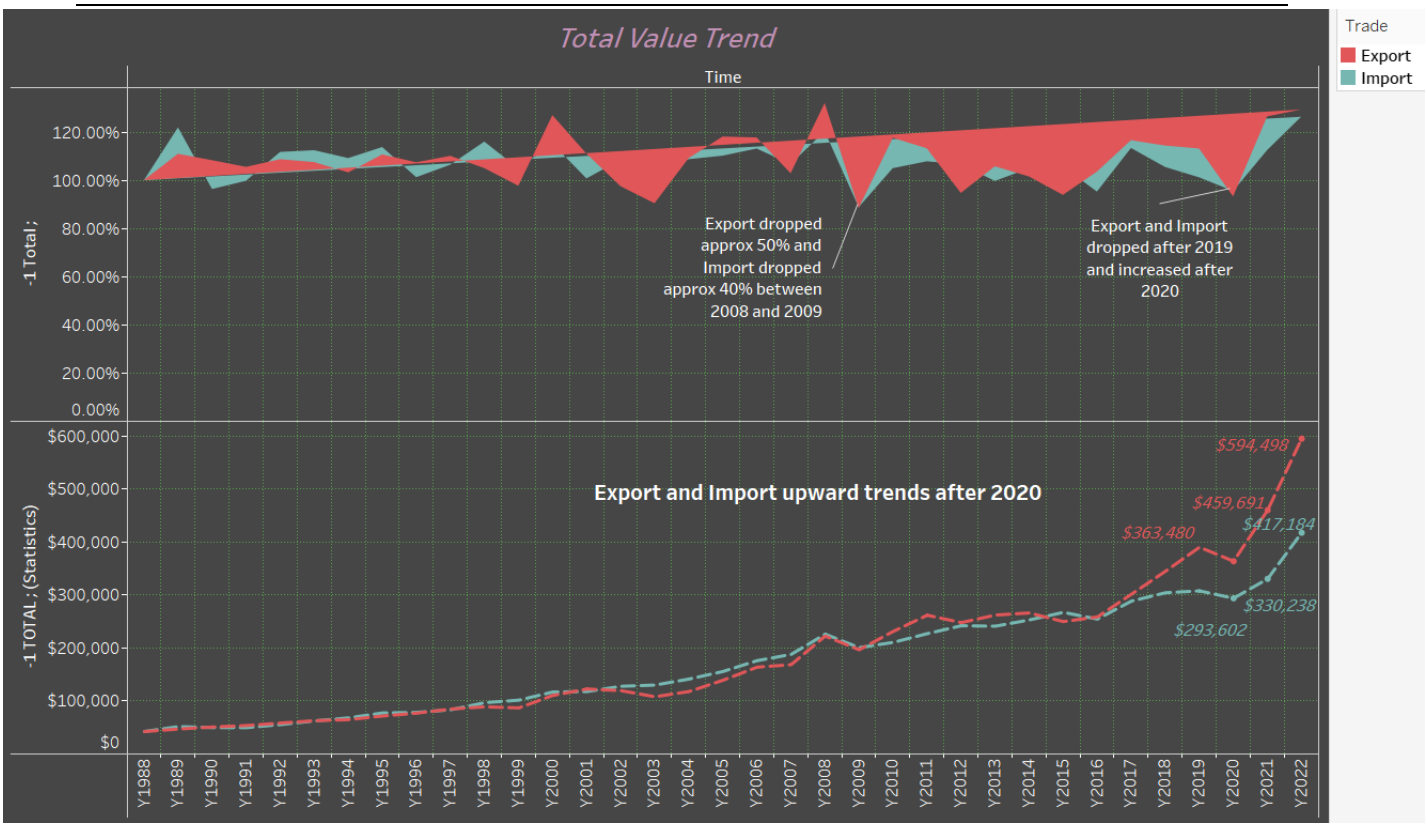

Figure 1: Raw dollar value trend graph with analytical and statistical view

The total value trend graph shows the dollar value of imports and exports from 1988 to 2022 along with its respective percentage change through the analytical point of view. Both imports and exports values fluctuate frequently where export dropped approximately 50% and import dropped approximately 40% between 2008 and 2009. This was due to the well-known "global financial crisis (GFC)" event where majority countries were under economic recession. A consistent increase in exports and imports values were increased from 2016 until 2019.

The increased in imports were due to the economic growth of Australia where the economy expanded by 2% in 2016-17 (ABS, 2017) and by 2.8% in 2017-18 (ABS, 2018). The increased in exports were likely due to the global economic growth as the "World Economic Situation and Prospects 2017" forecasted that it's expected to expand by 2.7% in 2017 and 2.9% in 2018 (United Nations New York, 2017).

However, exports and imports dropped dramatically during 2019 and 2020 but soon recovered after 2020. This was due to the global pandemic where serval countries were under lockdowns (including Australia) while it slowly recovers after 2020. Both exports and imports increased rapidly during the period where majority imports were likely covered by importing covid-19 vaccines (Pfizer), with a total of over 18 billion were invested in vaccine and Covid-19 treatment supply while majority of exporting were also likely covered by covid-19 vaccine (AstraZeneca) that was produced in Melbourne of Australia, to aid the scarcity of vaccines worldwide. Both exports and imports are expected to continue increase given its current upward trends after 2020.

For the Analytical trend, the polygon chart was used to clearly see the increase and decrease of values in the trades and additionally, showcasing its upward trending in values from 1988 to 2022 as the line slopes upwards. For the statistical trend, the line chart was used to best illustrate the dollar value of the trades, effectively showing trends and change points during certain year. Major change points

after 2020 where trades value increased dramatically were labelled with different colour, emphasises the aftermath effect of the covid-19 pandemic.

Analytical Trends

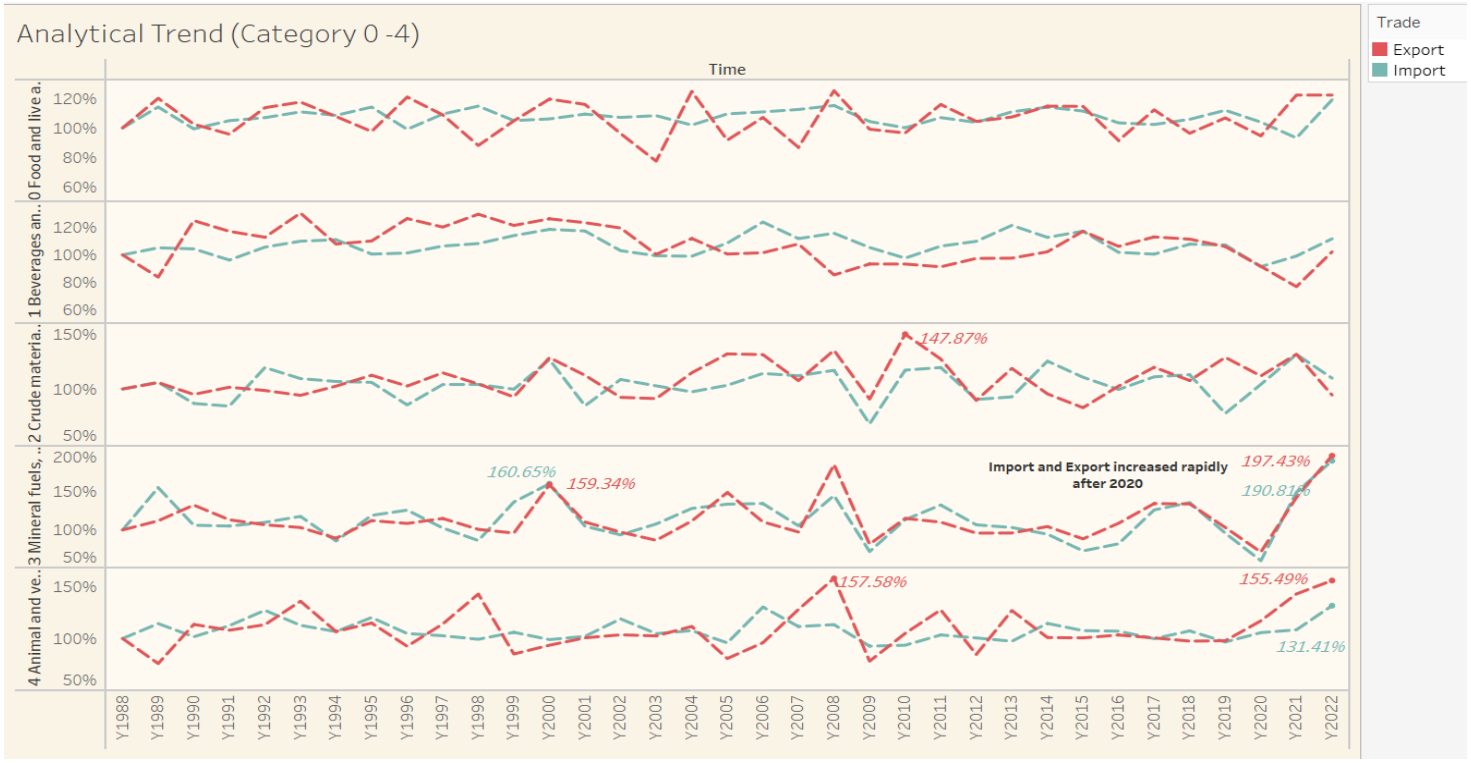

Figure 2: Analytical trend for category 0-4

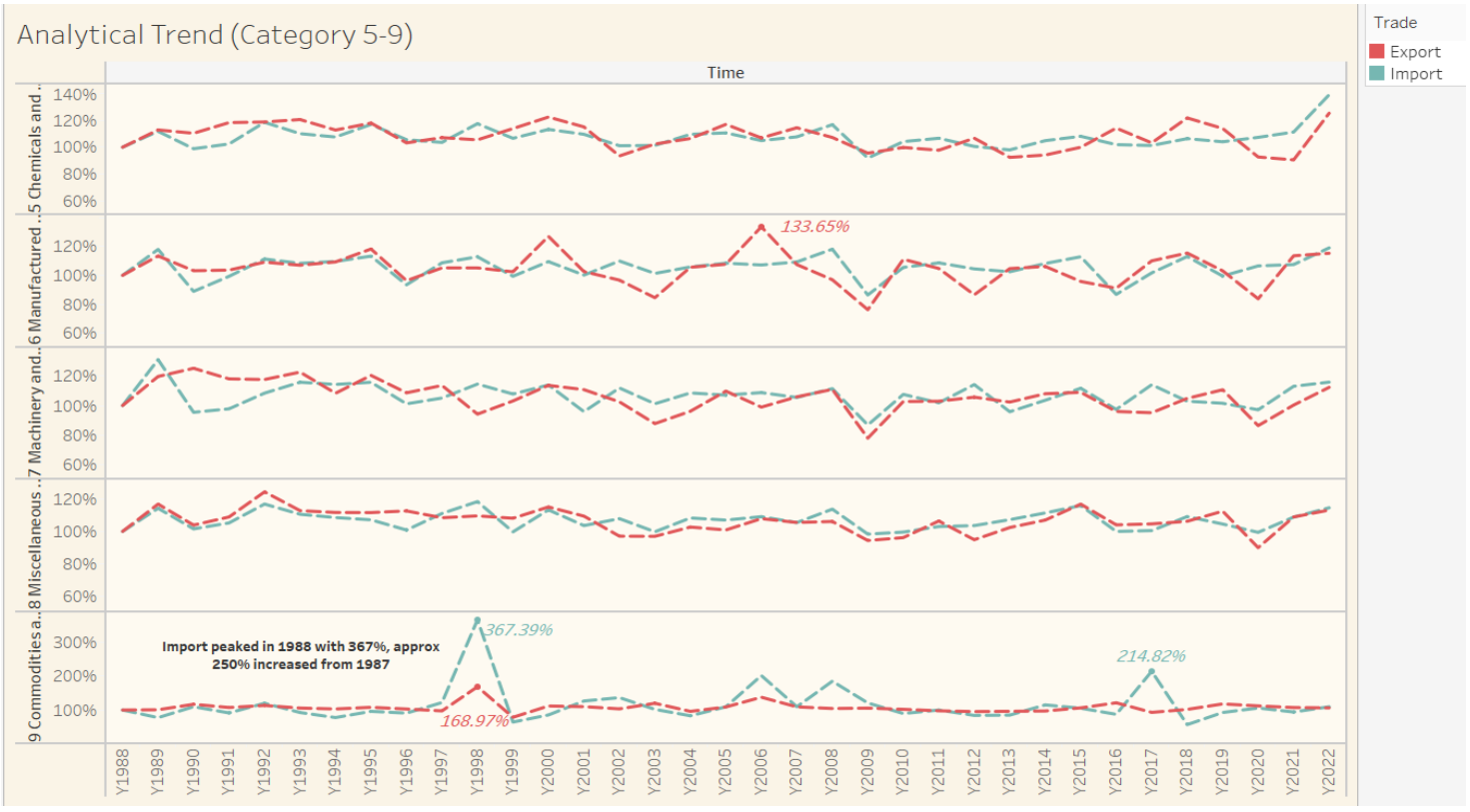

Figure 3: Analytical trend for category 5-9

The line chart in figure 2 and 3 shows the analytical view of exports and imports across 9 different main categories while figure 4 shows the impact of GFC on trades of all categories. In Category 3, its imports and exports has increased rapidly and sparked after 2020, with the trend of continuing increase in the upcoming years after 2022. Imports were sitting at an increase of 190.81% while exports sitting at an increase of 197.43% in 2022. This may have been caused by the "Russian-Ukraine war" in 2022 as natural gas exports increased almost 20% amid a global energy crisis (Mizen, 2022). Imports were also high likely due to the same event where the war have resulted in scarcity of mineral fuels globally. Both imports and exports for mineral fuels also increased simultaneously in 2000 and was likely due to an general upward trend in global commodity prices, including those for mineral fuels and in early 2000s, global economy was also under a strong economic growth which may have led to increased in demand of mineral fuels.

In category 4, exports gradually increase after 2005 and sparked at 157.58% in 2008. This may have likely be the result of favourable seasonal conditions which have led to higher supplies. Similarly, it also increased after 2020 with an increase of exports at 155.49% in 2022 and imports at 131.41%. Primarily, the vegetable oil has decreased in its supply due to serval factors which may have promoted the exports of Australia's vegetable oils. Drought has reduced soybean production in south America and canola production in Canada and the "Russian-Ukraine" conflict has disrupted sunflower-crushing facilities and exports from the Black Sea region (Austrade, 2022).

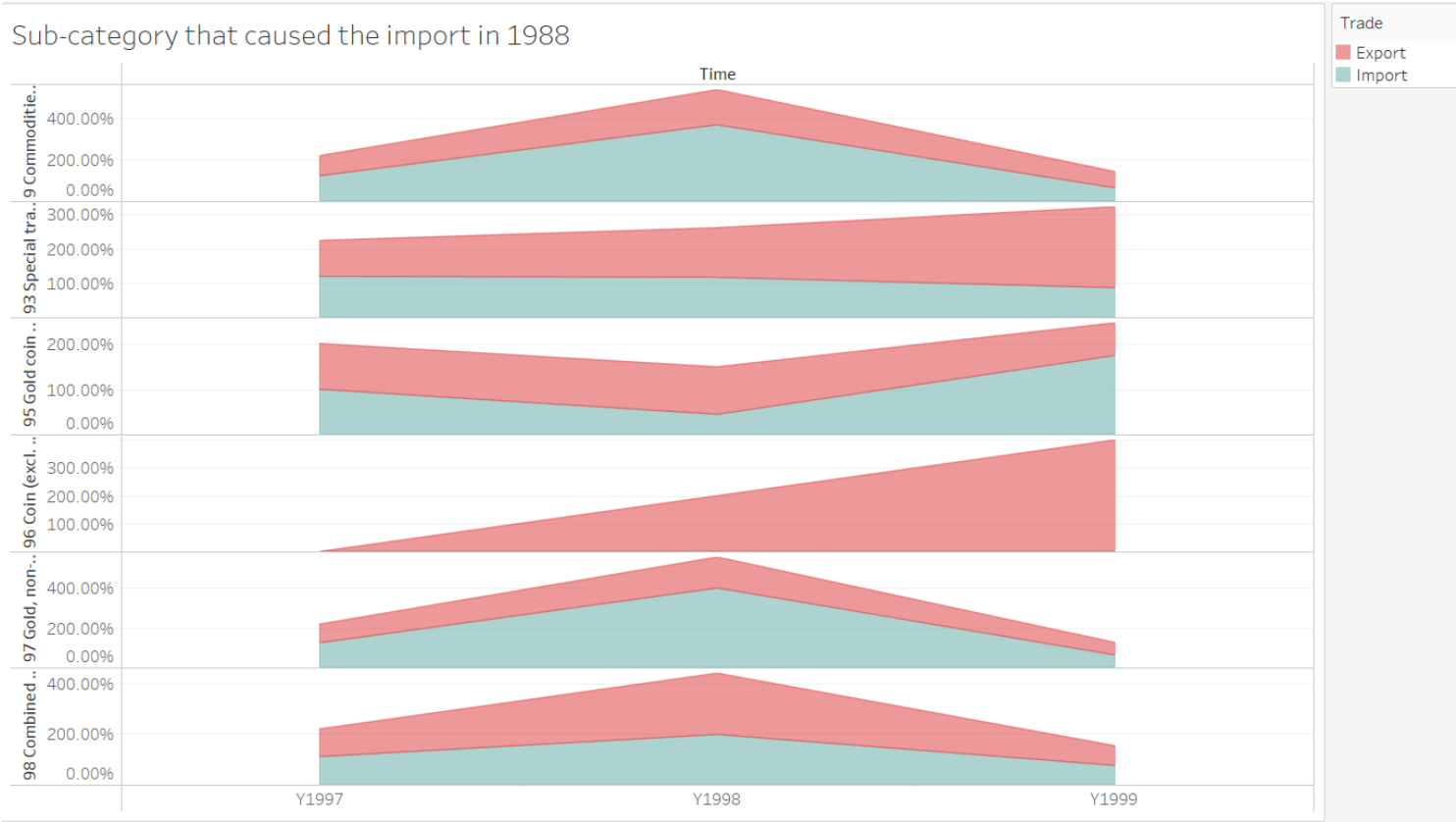

Figure 4: Sub-category that caused the unusual increased in imports for category 9

In category 9, its import hugely sparked between 1997-98 at 367%, approximately 250% increased from the previous year and additionally, under same period, its export also increased to 168.97% from the previous year. Although this huge, unusual increase was unknown, however, it was known that this increase in imports mainly came from its sub-categories of Gold (see figure 4) and it was noted that during 1988-89, these golds were imported for refining and re-export which resulted in rise of gold exports (DFAT, n.d.).

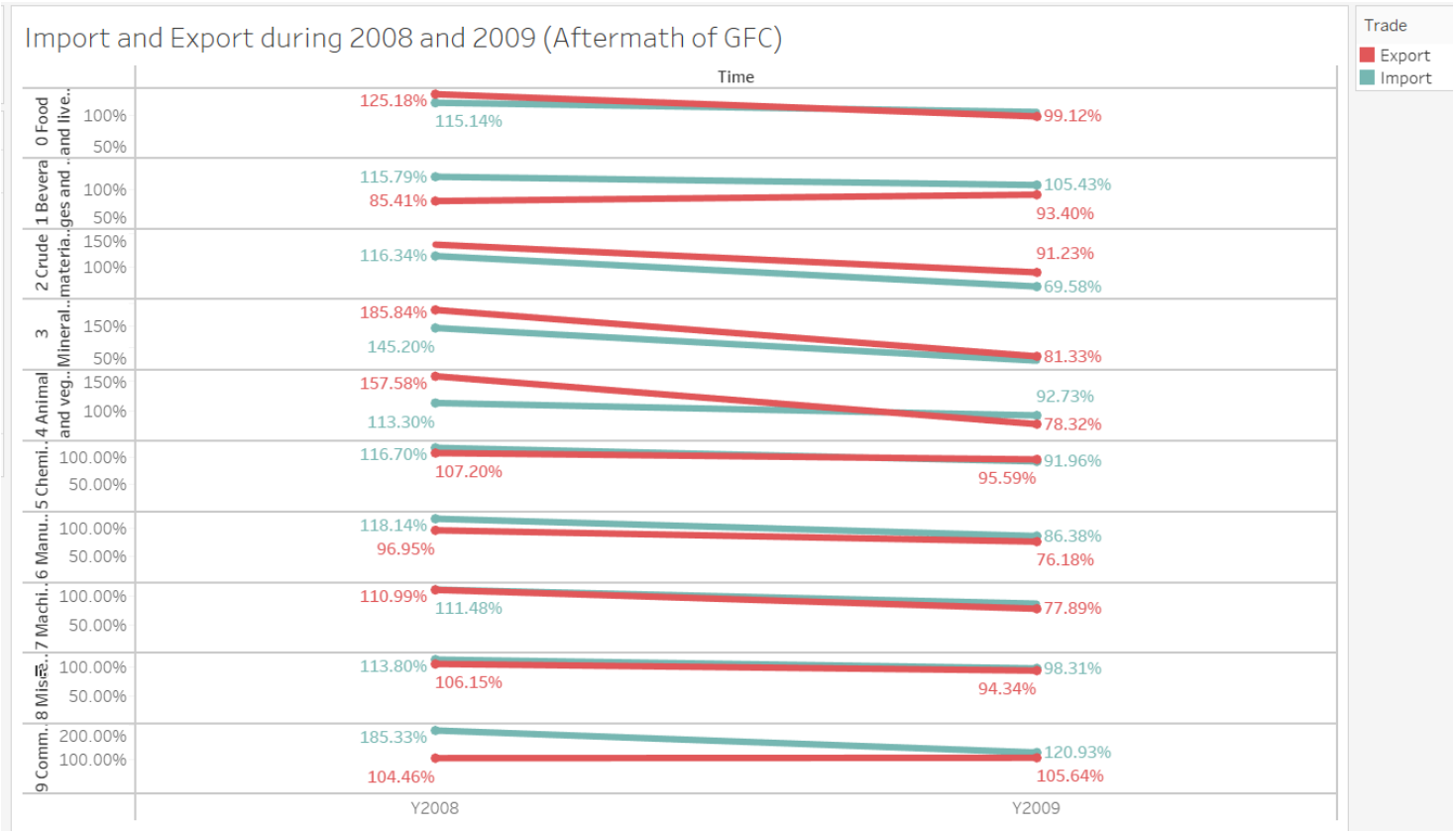

Figure 5: Impact of GFC on imports and exports during 2008-09

Figure 5 shows the impact of GFC on imports and exports for all categories. Interestingly as trades in most categories tends to decrease by certain percentages, some have increased during this period where commodities exports remained unaffected and slightly increased from 104.46% to 105.64% while beverages and tobacco's export increased from 85.41% to 93.40%.

Line chart was used for figure 2, 3, 5 to effectively show the percentage change in trades across time while area chart was used for figure 4 to create a clear comparison to showcase the storytelling of which sub-category resulted in massive increase in imports in 1988. Labelling was used to showcase the key change points as well as emphasising the significant percentage change during the periods. Some annotations were performed on figure 2 and 3 to enhance its storytelling, guides user's eye contact to the event. Additionally, all values were converted from decimals to percentage in which the graph were able to convey the story effectively and eases user's reading. Different colour scheme was used to help differentiate between imports and exports, allowing a clear comparison between the two.

Statistical Trends

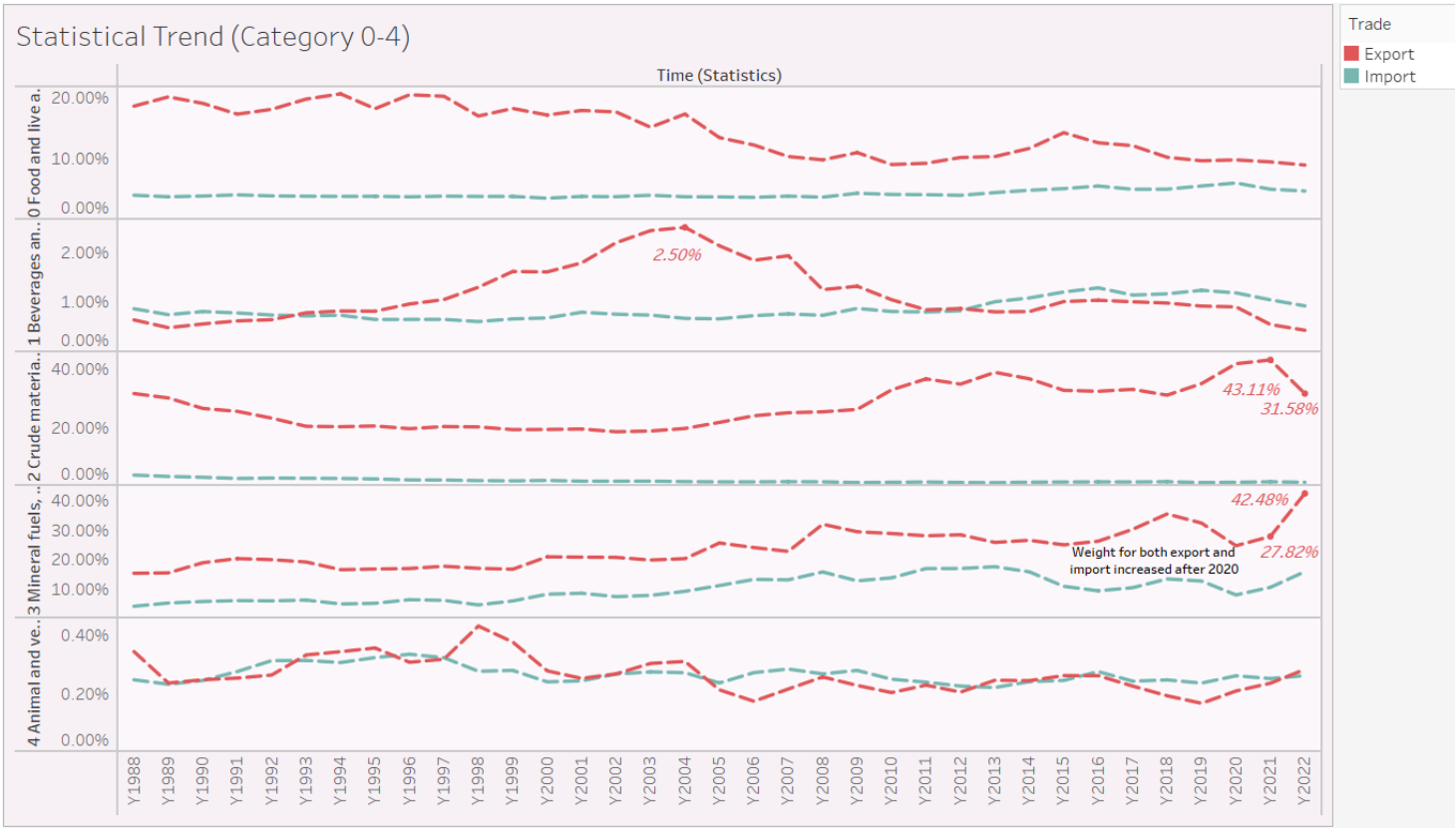

Figure 6: Statistical trend for category 0-4

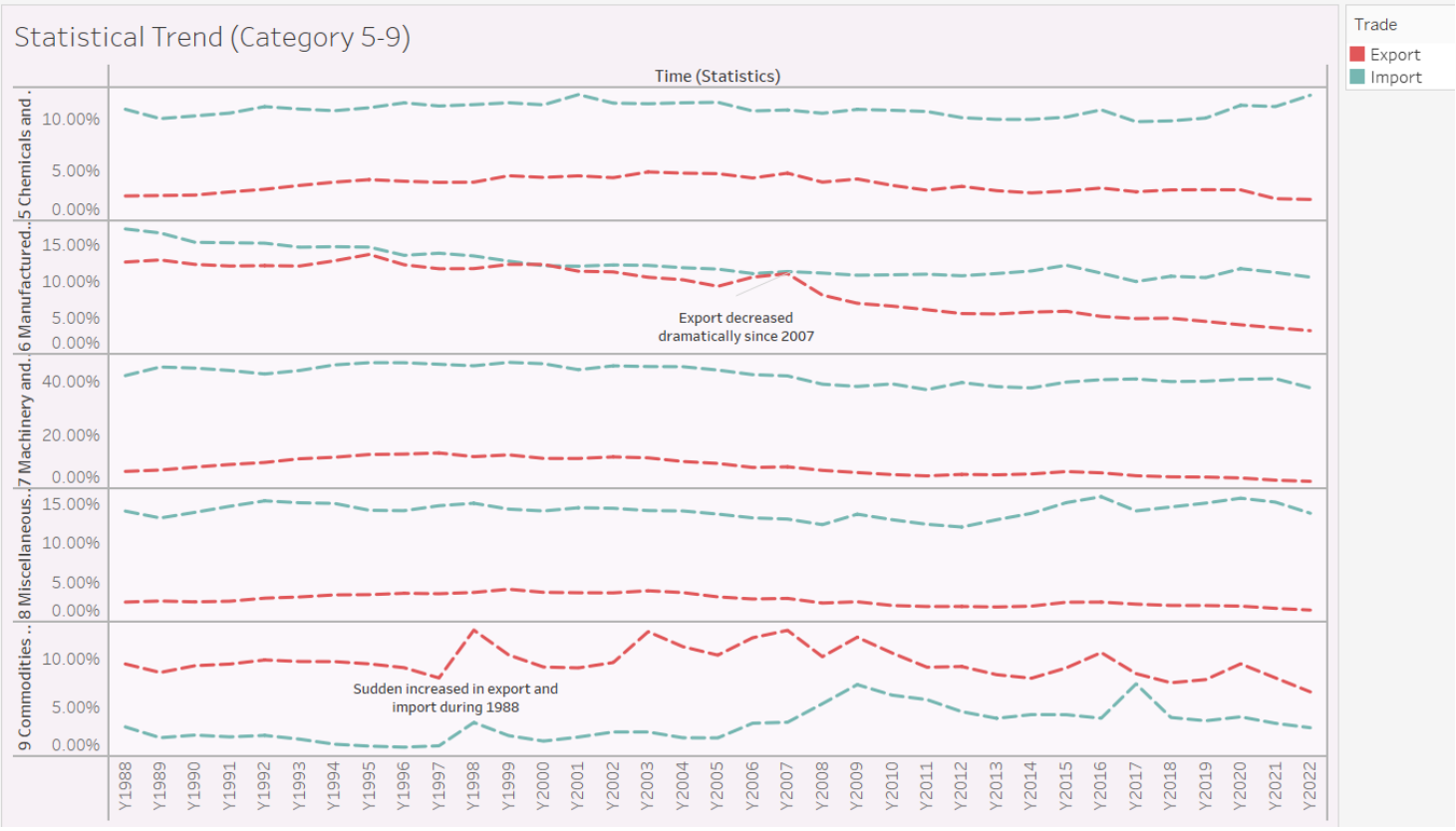

Figure 7: Statistical trend for category 5-9

Figure 6 and 7 shows the statistical representation of the imports and exports for all categories. In category 1, export values gradually increased after 1995 and peaked in 2004 where 2.50% of total export values were covered by category 1. Through Figure 2, it is noticeable that category 1 exports did not fluctuate much during the same time. Thus, possible causes may be the increase in export prices where AUD was appreciated during such period. In category 3, the export values peaked in 2021 with 43.11% of the total value while it dropped in 2022 to 31.58%. This was likely caused by the after effect of Covid-19 as during the pandemic, world's largest crude material supplier USA was under severe lockdowns, thus couldn't supply enough crude materials. As lockdown eased in USA, Australia's export of crude materials therefore decreased. In category 6, export values were gradually decreasing since 2006. This was likely due to competitions where other countries such as China, were able to offer manufacturing at a lower price. In category 9, the sudden increased in values of exports and imports was also reflected in figure 3 where percentage of imports and exports have also been increased during 1988.

Line charts were chosen to analyse the statistical representations of the imports and exports as it was the most suitable and effective way of showing the percentage change in values of all trades across time. Some labelling as well as annotation provides user with a stronger focus on these major change events during the period. Colour was used, again, for differentiation purposes between imports and exports to allow a clear comparison.

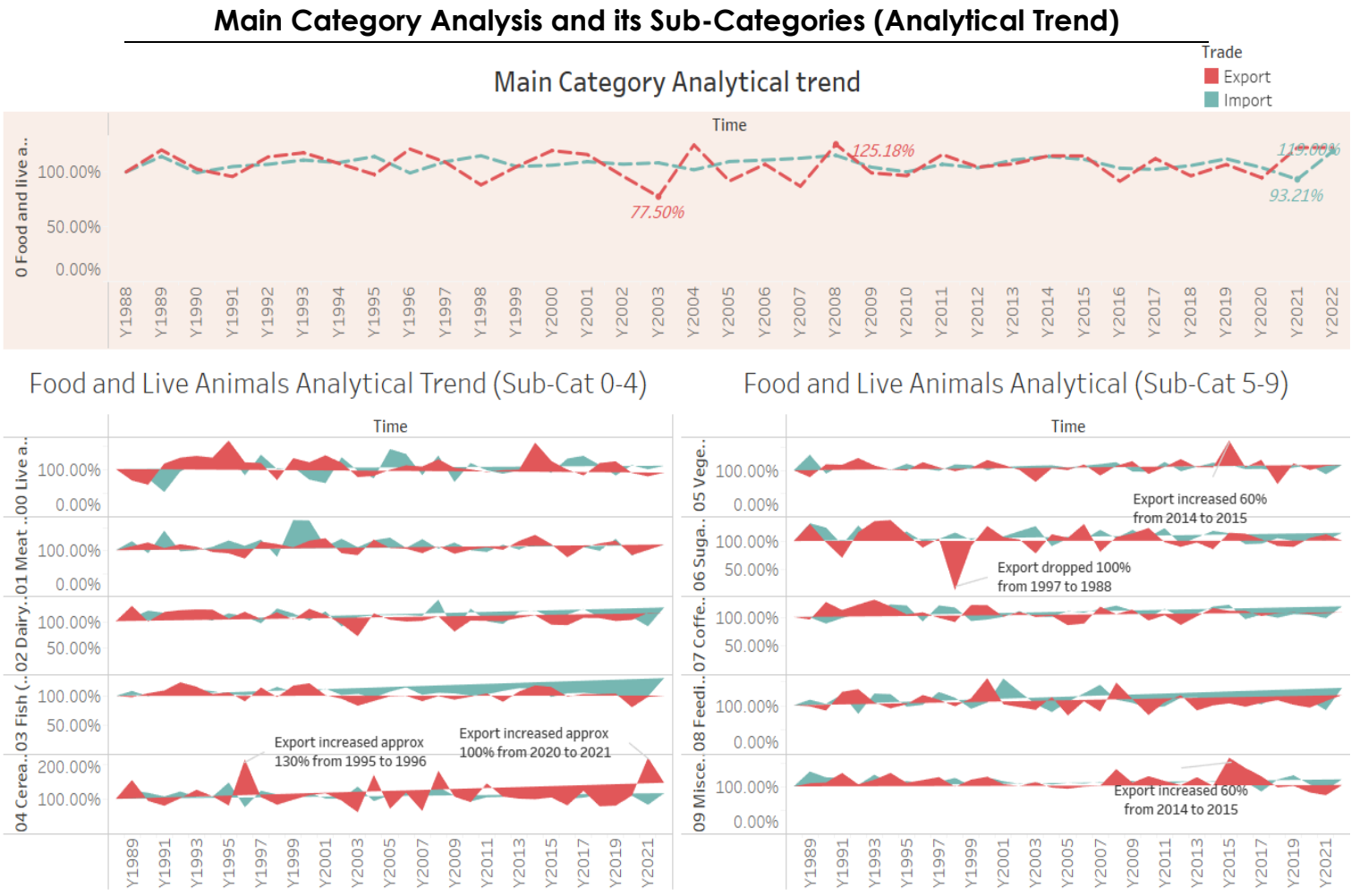

Figure 8: Dashboard showing the analytical trend between the main category and its sub-categories

Figure 8 shows the analytical representation between category 1 and its sub-categories. Through the graph, it can clearly see that the category's export is extremely volatile with the highest drop in exports in 2003 to 77.50% while it peaked in 2008 to 125.18%. During the Covid-19 pandemic between 2019-2021, both export and import dropped however, export increased during 2021 while import dropped to lowest to 93.21%. This was possibly due to excess supply within Australia while demand of other countries increased due to severe lockdowns. Both imports and exports trends upward after the pandemic was officially over during 2022.

In sub-category 0, export had a few sparks from 1990 to 1995 as well as 2013 to 2014. In sub-category 1, major spark was in its import from 1999 to 2000. While sub-category 2 and 3 remains relatively stable over time with its trade, with a minimal fluctuation. However, in contrast to sub-category 4, its export fluctuates consistently, with an export increased approximately 130% from 1995 to 1996. Export was then underperformed during 2012 until 2020 and had another increase of approximately 100% from 2020-2021. After 1996, its exports continued to decrease after a period and this was likely caused by the "Millennium Drought" which occurred between 1997 until 2009, posed a threat to the agricultural which resulted in poor wheat productions (BOM, n.d.). Similar drought event also occurred during 2017-2019 which also resulted cereals export to dramatically decrease after 2017 and recovered in 2020 as drought was over. As the supply increases, it caused a spark in cereals export in 2021 as Asia countries such as China, seeks imports from major grain producers such as Australia to meet its consumptions needs (Austrade, 2022). Current trend is showcasing that exports for cereals will continue rise in the future given its ability to be able to supply and fulfill the needs of the current demand.

In sub-category 5, its export and imports are relatively stable while export had a major increase of 60% from 2014-2015. This may be possibly resulted by favourable weather conditions which drove supplies of vegetables and fruits high which therefore led to a decrease in its price, thus resulting in more exports. In sub-category 6, a dramatic decrease in exports from 1997 to 1998 where it dropped approximately 100% from 104.49% to 10.45%. While it was unknown why such incident has occurred, however, it may be result of dry conditions in Australia during late 1996 and intensified during the strong 1997 "El Nino" event. Dry conditions will ultimately result in poor production of sugar canes, thus poor production of sugars. In sub-category 9, its export and imports rarely decrease and interestingly, its export increased approximately 60% from 2014 to 2015 however, it decreased after 2019 due to effect of the Covid-19 pandemic.

Line chart was chosen to analyse the analytical pattern for the main category to clearly show the fluctuations of imports and exports over time while also able to highlight the lowest drop point and highest increase using the labelling technique to convey a story. Polygon chart was used for analysing all sub-categories to illustrate the major sparks in trade in certain time as well as downfalls. Some key annotations were given to highlight the major change points and events for all sub-categories.

Main Category Analysis and its Sub-Categories (Statistical Trend)

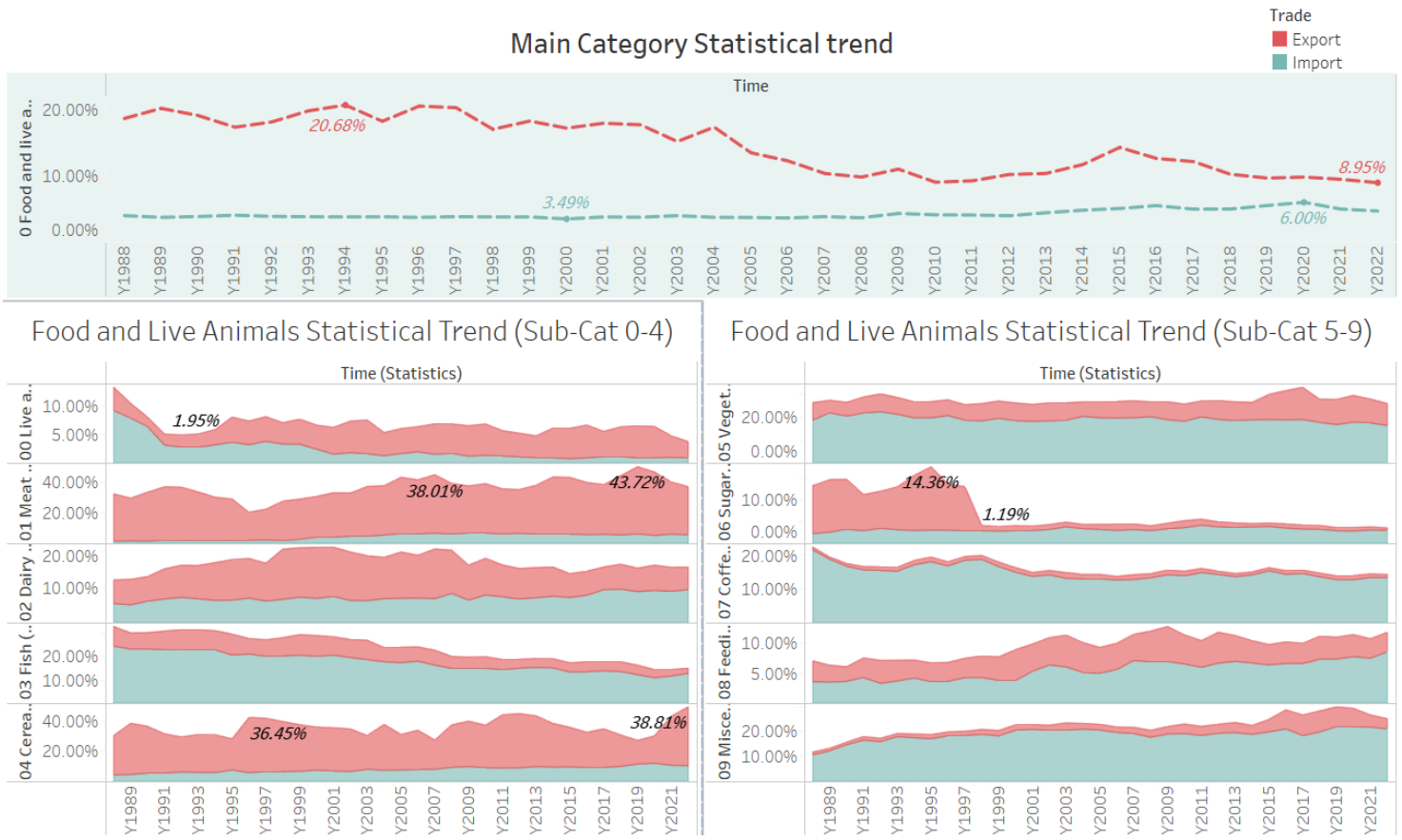

Figure 9: Dashboard showing the statistical trend between main category and its sub-categories

Figure 9 shows the statistical representation between category 1 and its sub-categories. Interestingly, even when exports of the category trends upwards (See figure 8), its total value have been decreasing over time, with the highest peak at 20.68% in 1994 while currently with the lowest rate of 8.95% in 2022. The imports value however, have been increase gradually over time with the lowest at 3.49% in 2000 and highest at 6% in 2020. This is showcasing that as competition for the category increased over time, the prices as well as demand from Australia decreased over time. High import value rate in and low export value rate during 2020 may likely caused by the economic downturn due to Covid-19 pandemic where AUD depreciated, resulting in higher import costs and lower export values given the same number of trades.

In sub-category 0, its value for exports and imports falls dramatically from 1988 to 1991 with the lowest being 1.95%. In sub-category 1, its export value gradually increased from 1998 until 2007 with a peak of 38.01% and decreased afterwards due to the GFC. The trend for category 1 continues to trend upwards after the GFC and reached a peak at 43.72%, however, decreased again due to Covid-19 pandemic. Interestingly in sub-category 3, its import and export values decreased overtime, specially from 2001. According to the Department of Agriculture (2015), Australia's seafood value has decline from its peak in 2000-01 which are the result of economy boom during 2001 that caused AUD to appreciate, thus, making export more expensive for foreign countries. In sub-category 4, the export value increased from 1995 to 1996 to 36.45% as well as increase in 2021 to 38.81% in respective to the increase in exports during the periods as shown in the analytical trend (See figure 8). The trend of its export values is expected to continue increase in the future while its import values will remain stable.

In sub-category 5, the export value increased from 2014 to 2015 in respective to the 60% increase in exports during the period (See figure 8). In sub-category 6, due to exports decreased approximately

100% during 1997-98, this has resulted its value to drop from 14.36% to 1.19%. Its export remains relatively low across time afterwards. For sub-category 8, its export and import values slowly increased over time, showcasing the trend of continuous increase in the future. In sub-category 9, its export and import values increased during 2014-15 and dropped during 2020-21 in respective to the increase and decrease in exports and imports as illustrated in figure 8.

Line chart was chosen to analyse the statistical trend for the category as it can effectively convey key change points and story over time. By using labelling techniques highlighting the highest and lowest export and import values, users are able perceive the performance of the category currently by comparing the figure now to the recorded highest and lowest record. The area chart was chosen for analysing the statistical trend for all the sub-categories to clearly illustrate sub-categories that contributed to the most imports or exports value to the total value of the category. For example, as shown in sub-category 0, its percentage were relatively low to sub-category 4, showcasing trades within that sub-category is low and less significant of impacting the overall increase/decrease in exports and imports value of the main category. It was also an effective way of illustrating key changes in patterns while in an aesthetic and ease understanding formats.

Relationship between Main category and its Sub-categories

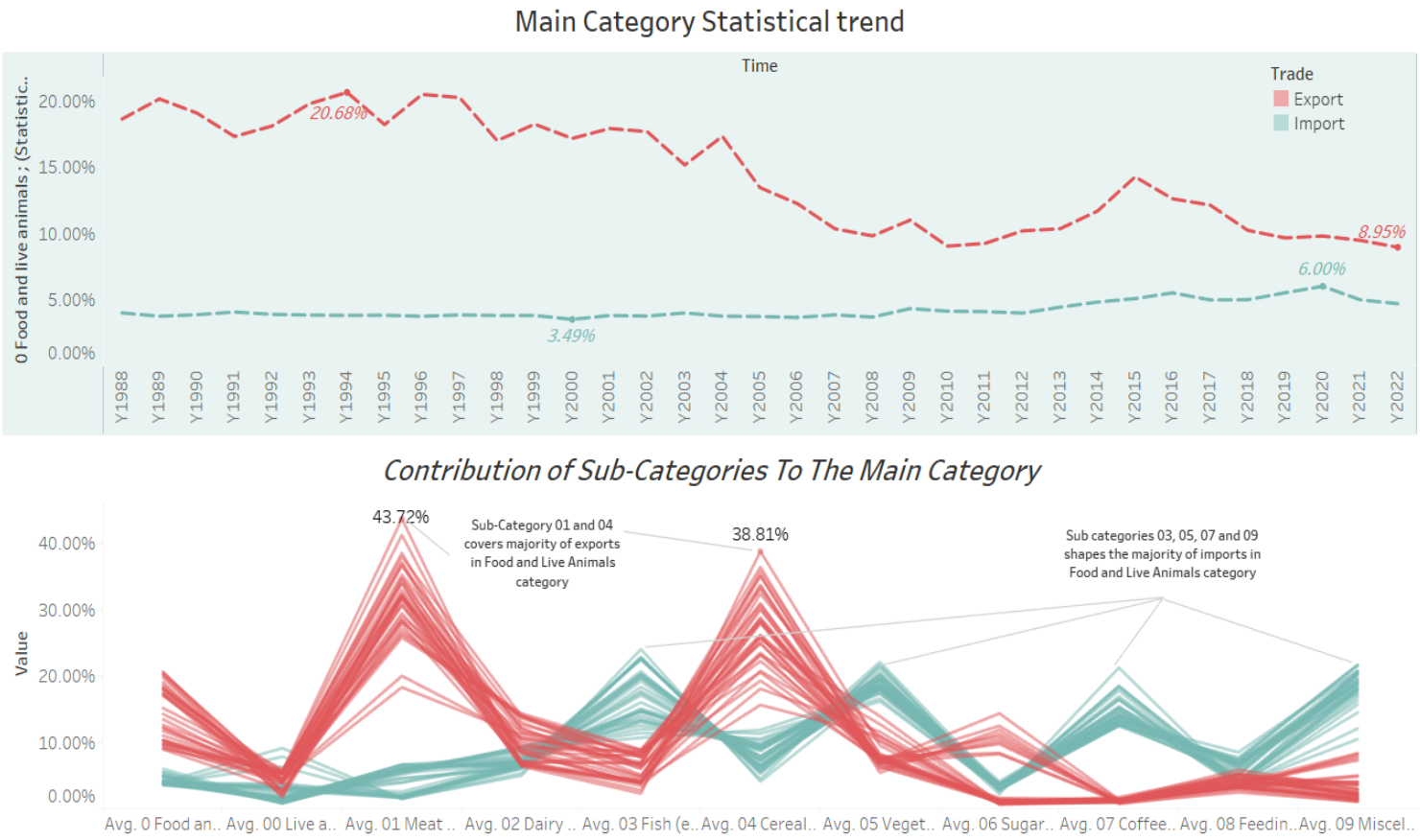

Figure 10: Dashboard showing the contribution of sub-categories to the main category

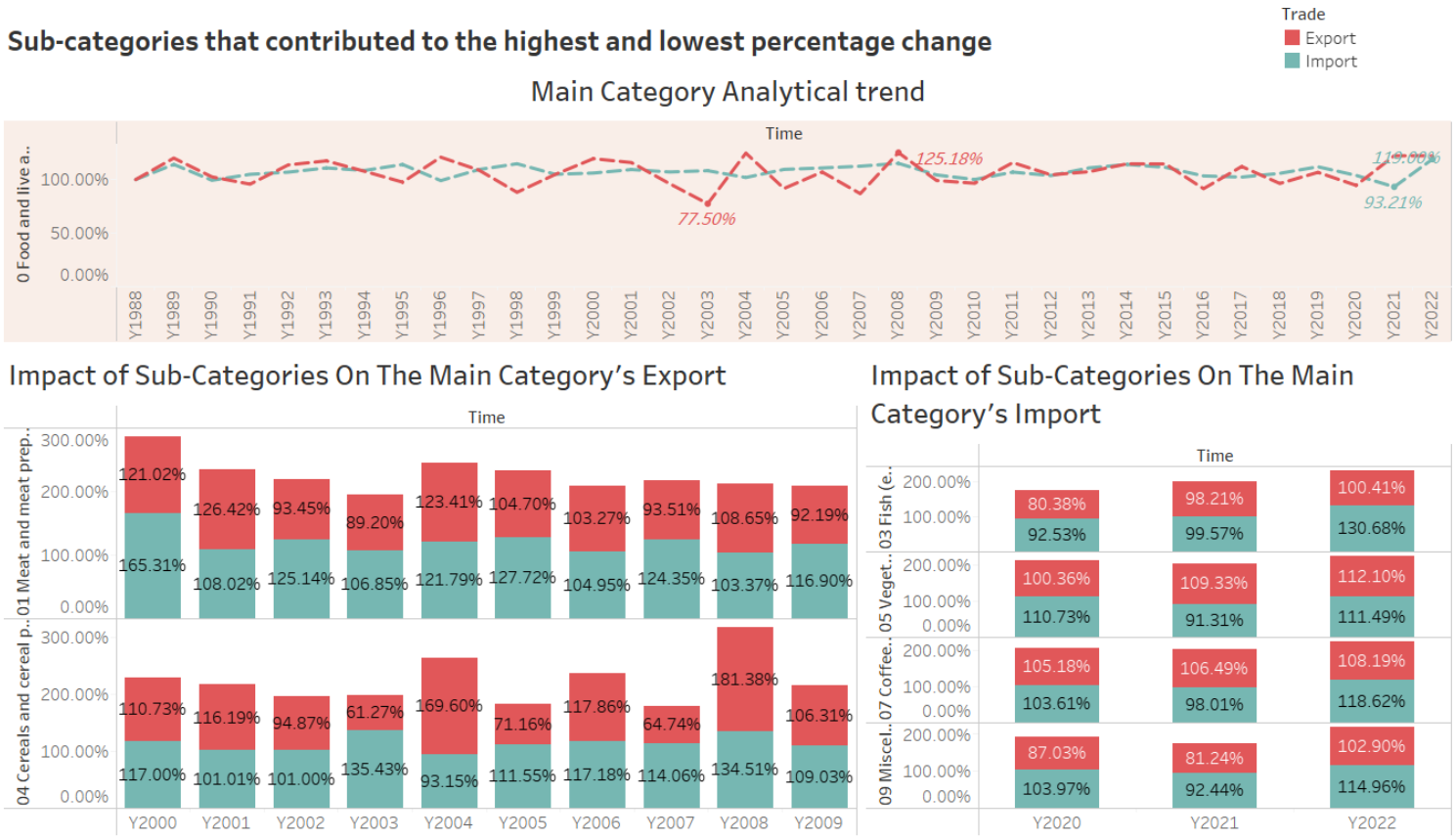

Figure 11: Dashboard showing the sub-categories that contributed to the highest and lowest percentage change

In figure 10, the parallel coordinate illustrates the sub-categories that have contributed the most to the imports and exports of its main category. It can be clearly seen that sub-categories 1 and 4 contributed the most to the total exports of the main category while sub-categories 3, 5, 7 and 9 contributed the most to the imports of the main category.

In figure 11 however, shows the sub-categories that contributed to the lowest and highest percentage change of the main category. For exports, major downfall was in 2003 with 77.50% while major peak was in 2008 with 125.18%. The bar graph on the left consists of the sub-categories that had highest influence on total exports as illustrated in figure 10 and is compared across time between lowest and highest change points. It can be clearly seen that lowest downfall in 2003 as well as major peak in 2008 from the main category was highly influenced by sub-category 4 as it decreased from 94.87% to 61.27% in 2004 and increased from 64.74% to 181.38% in 2008 respectively. Similarly, the bar graph on the left consists sub-categories that had highest influence on the total imports as illustrated in figured 10. During 2021 with main-category's major downfall, sub-category 5 contributed to the most as it decreased from 110.73% to 91.31%. Main category's major peak in 2022 were mainly contributed by the increase in sub-categories 3 from 99.57% to 130.68%.

Ultimately, parallel coordinate was used to effectively visualize the high dimensional data from each of the sub-categories, allowing the user to identify which sub-categories had the most imports/exports and its contribution to the overall changes in the main category. Annotations were used to further emphasise this and directly guides user to the main context/story displayed by the graph. Bar graphs were used to clearly covey the storytelling of the changes in percentage directly in an understandable format and with the labelling technique, figures and storytelling of the context is presented more effectively.

Storyboard

Storyboard is an effective way of summarising the stories of the context in an interactive way for users to engage with. In the below storyboards, it will summarise the key context related to category 0 and its sub-categories in which was most covered earlier in the report. A clearer view and interactions of the stories can be accessed through Tableau.

Slide 1: Illustrates the impact of category 0 on the total imports and exports. Through the story, it shows that category 0 has contributed to the 3rd most in total exports while in 5th most in total imports out of 8 other different categories which are quite influential in terms of total exports value in Australia

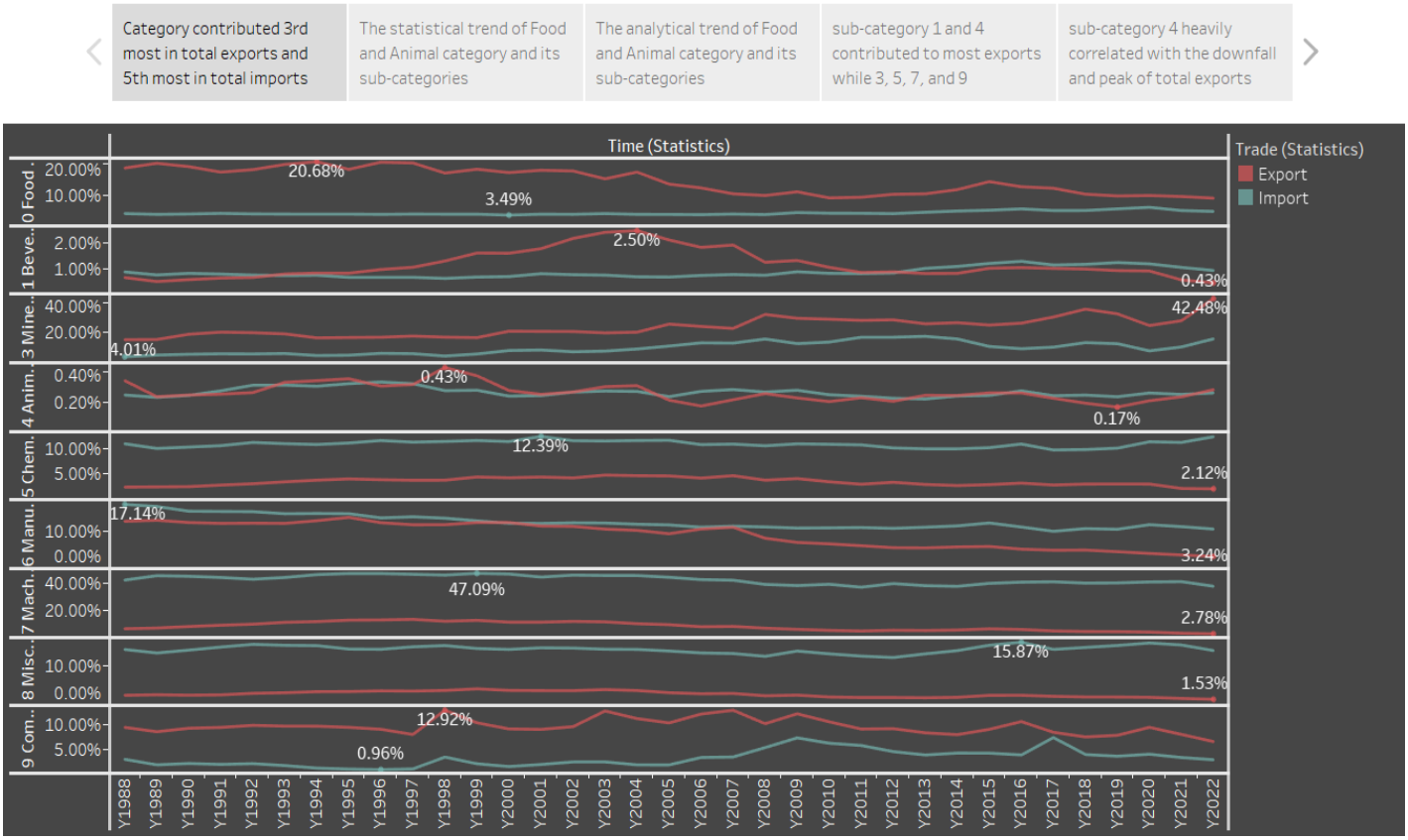

Figure 12: Storyboard showing the contribution of category 0 to the total imports and exports in Australia

Slide 2: The analytical trend of category 0 ad its sub-categories. Key events have dramatically decreased the exports of some sub-categories (as shown in the analytical trend), thus declining its values and weight in against with the total value of the main category

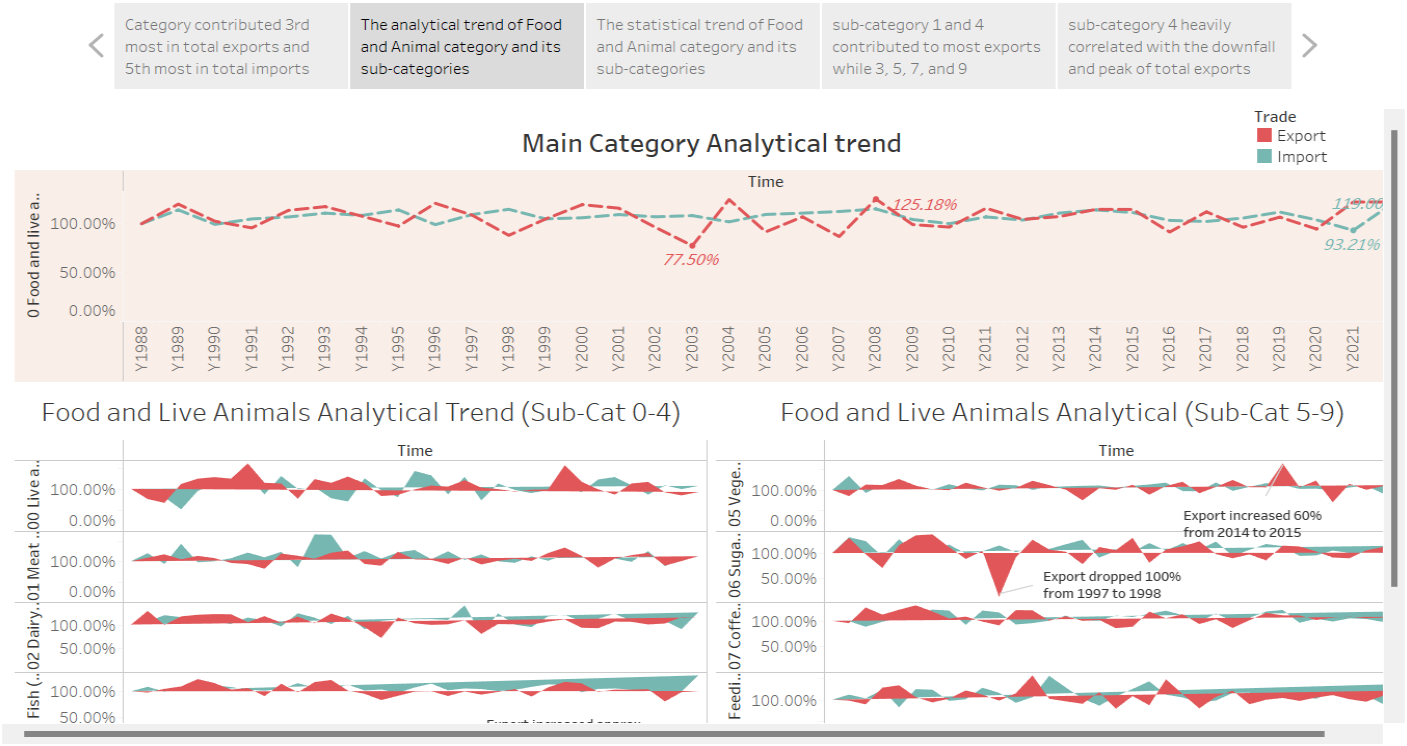

Figure 13: Storyboard showing the analytical trend of category 0 and its sub-categories

Slide 3: The statistical trend of category 0 and its ten sub-categories. Some key events such as GFC and Covid-19 pandemic have highly influenced on the imports and exports of each sub-categories, ultimately affecting the overall value of the main category

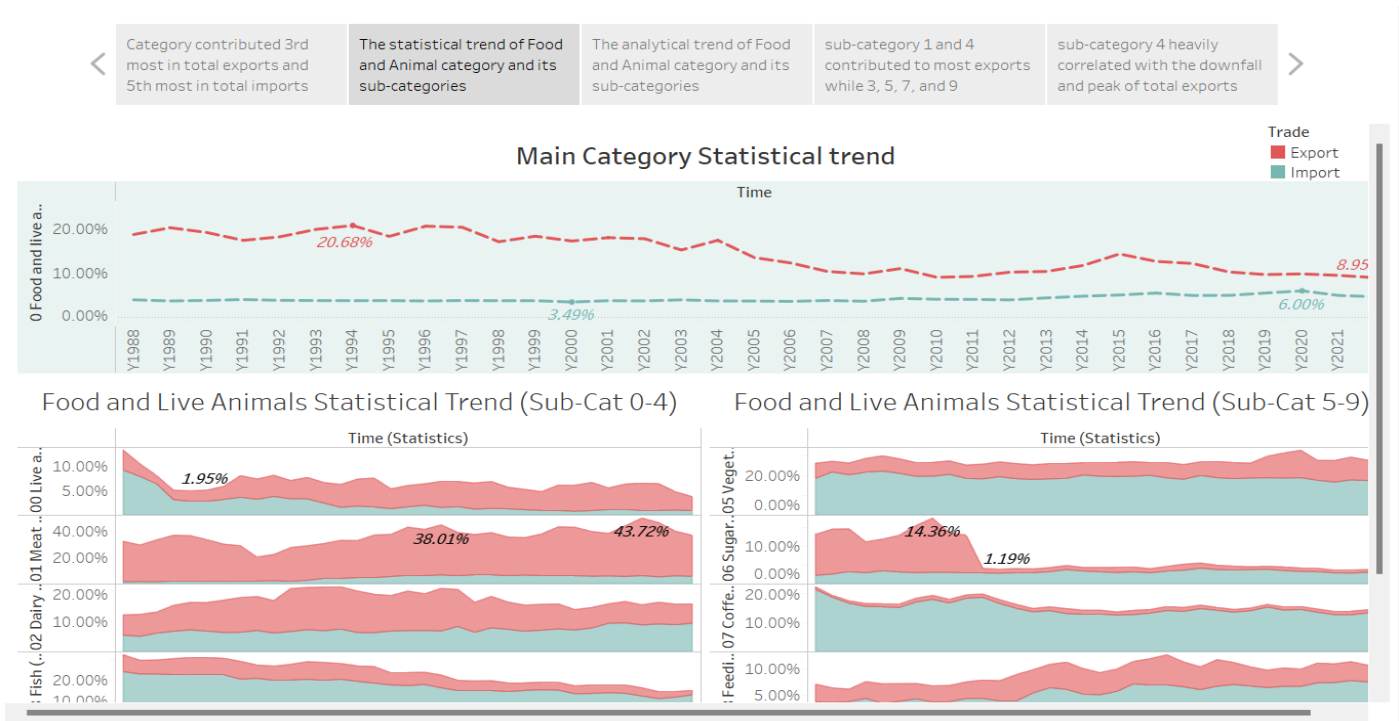

Figure 14: Storyboard showing the statistical trend of category 0 and its sub-categories

Slide 4: Sub-category 1 and 4 have contributed to most exports of the total exports while 3, 5, 7 and 9 have contributed to most imports of the total imports of the main category

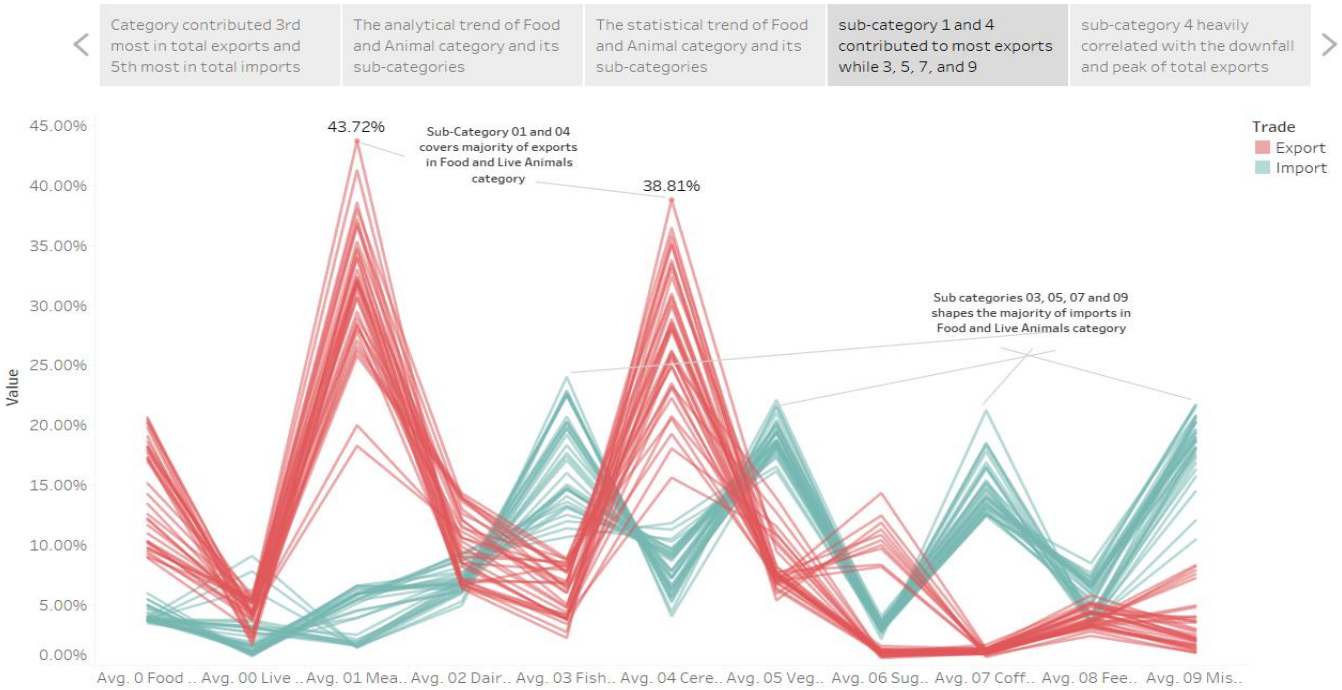

Figure 15: Storyboard showing the contribution of sub-categories to the total exports and imports of category 0

Final Slide: sub-category 4 heavily correlated with the downfall and peak of total exports while sub-category 5 contributed the most to downfall while sub-category 3 contributed most to peak of the total import

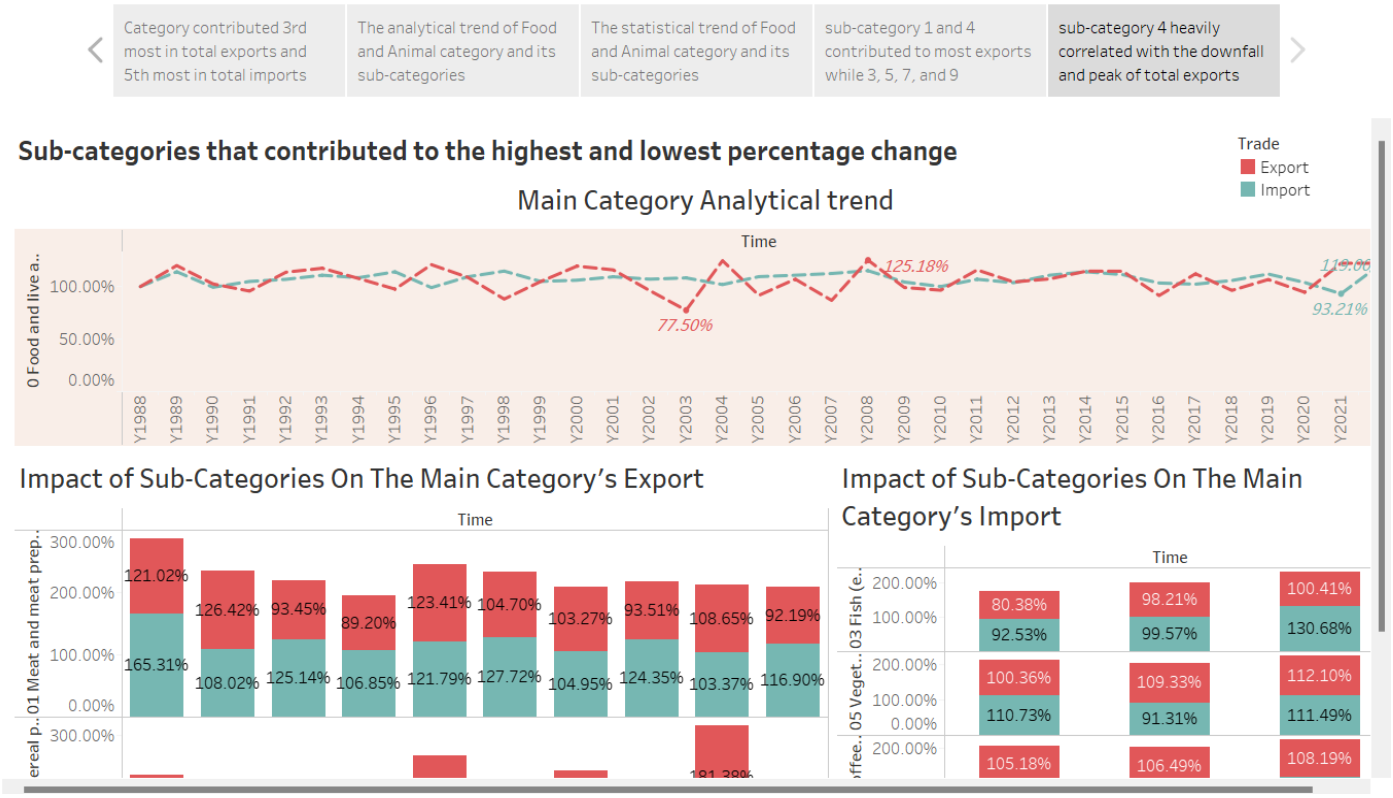

Figure 16: Storyboard showing the contribution of certain sub-categories to the pitfall and peak in total imports and exports in category 0

Advantages and Disadvantages of Tableau Dashboard and Storyboard

Methodologies	**Advantages**	**Disadvantages**
Dashboard	• Integrating different graphs into one place	• Limitations of adapting different screen size
	• Data clarity	• Lack of customization
	•	•
	• Real time analysis	• Could be overwhelming to look at
	• Interactive graph	• Accidently changed graph in dashboard changes the original graph
Storyboard	• User engagement	• Can be time consuming when dealing with large dataset
	• Presentation-ready	• Risk of information overload
	• Story point annotation	• Dependency on storytelling skills
	• Seamless transitions	• Potential for over-simplification

Summary and recommendations

To summarize, imports and exports of different categories are affected by different events across time with some major events such as GFC and Covid-19 pandemic while some minor events such as climate conditions and economy also plays a role in effecting the supply and demand of the different categories, thus resulting in an increase or decreases of imports and exports. Category 0 and its sub-categories were chosen for a closer study. As the category involved with "Food and Animals", it was highly sensitive to the economy conditions as well as climate conditions such as drought which are severe for food productions. As of no difference to other categories and sub-categories, GFC and Covid-19 played an equal role in effecting all exports and imports rates during the period.

As sub-category 1 and 4 played an important role in total exports of category 0, it is essential to ensure the prices are adjusted according to the market value in order to effectively compete with other countries export of same products. Additionally, it is critical to ensure the supply of products in these sub-categories is optimal to meet the demand from countries importing the products. As sub-categories 3, 5, 7 and 9 are most imports from other countries, such costs can be reduced by growing industries locally which can produce the same goods. This can effectively hedge against unknown circumstances where other countries failed to supply these goods or as exchange rate differs, resulting in higher costs of imports.

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